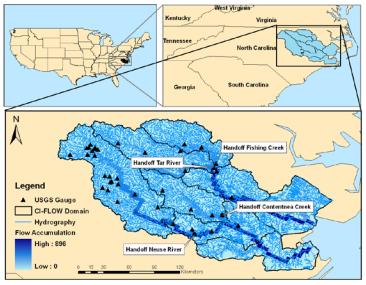
NOAA National Severe Storms Laboratory

CI-FLOW

Coastal and Inland Flooding Observation and Warning (CI-FLOW) is a demonstration project that predicts the combined effects of coastal and inland floods for coastal North Carolina. CI-FLOW captures the complex interaction between rainfall, river flows, waves, tides and storm surge, and how they will impact ocean and river water levels. If implemented operationally, benefits include the potential reduction in loss of life and property from weather and water hazards in the Carolinas and across our nation.

Addressing a need along vulnerable coasts

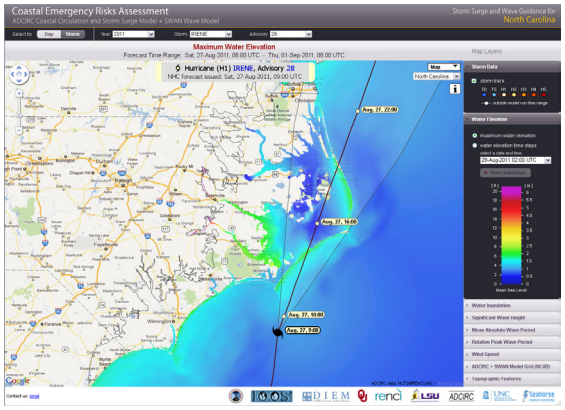
CI-FLOW is motivated by NOAA's critical forecast need for detailed water level predictions in coastal areas. Coastal flooding threatens more than half the nation's population and a wealth of natural and economic resources. Storms cause coastal flooding when water from the ocean is driven onto land by wind, tides, waves and storm surge. The severity of these floods can increase when intense rain falls upstream on rivers influenced by tides. CI-FLOW simulates the combined effects of coastal and inland floods.

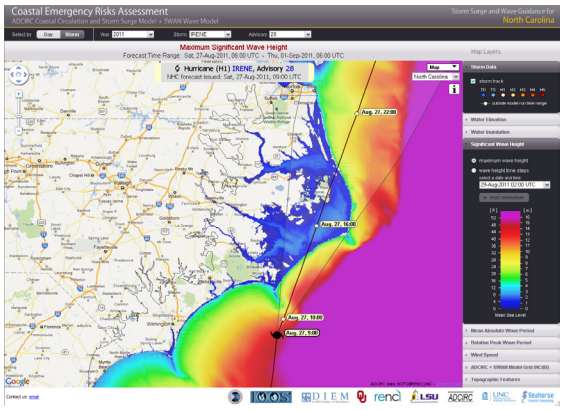


The CI-FLOW demonstration project focuses on coastal North Carolina.

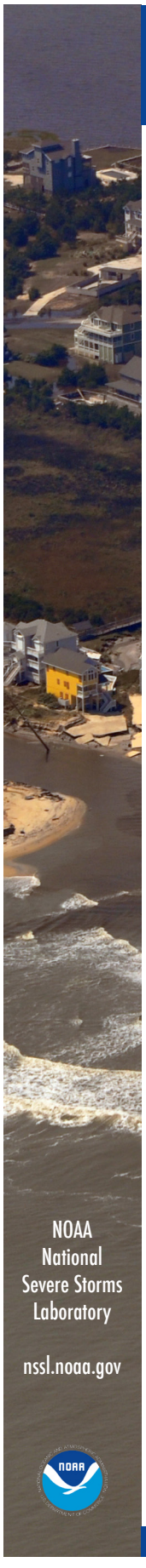
Connecting rainfall to rivers and oceans

To provide communities with estimates of total water level from storms, many sources of data must be included. CI-FLOW collects data from a computing system that combines radar and rain gauge information to create five-minute estimates of rainfall. This information is passed on to water quantity models that simulate freshwater flows from the headwaters of the basins into the rivers; taking into account soil type, slope of the land and vegetation patterns. The CI-FLOW system then passes water flow data from river models to a coastal circulation and storm surge model that provides simulations of waves, tides and storm surge. As storms approach, forecasters provide feedback on how well the CI-FLOW system estimates total water level.





The Coastal Emergency Risk Assessment website shows the location and track of Hurricane Irene at the time of Advisory 28. CI-FLOW products predict the maximum water elevation (above) and maximum significant wave heights (below).

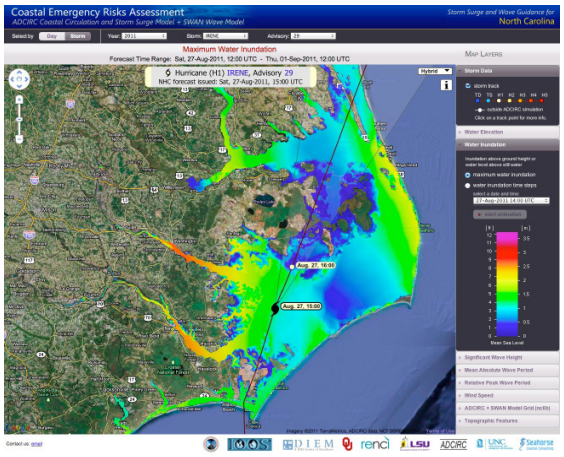


NOAA National Severe Storms Laboratory

nssl.noaa.gov

Hurricane Irene

CI-FLOW began producing real-time 84-hour simulations of total water level in coastal North Carolina from Hurricane Irene on Tuesday, August 23 2011, before it made landfall near Cape Lookout, North Carolina. CI-FLOW total water level simulations were compared with high water marks collected after Hurricane Irene by the USGS and other partners. Researchers found that 81% of the high water marks were within +/-0.5 meters of the predicted water levels.



CI-FLOW predicted water levels above sea level at the time of Hurricane Irene's landfall.

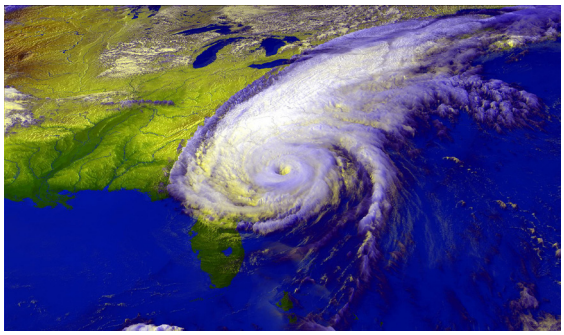
Hurricane tragedies drive CI-FLOW partners

In response to the devastation in North Carolina left by Hurricanes Dennis and Floyd in 1999, a diverse group of people, including state, regional, academic and federal partners formed CI-FLOW with a united goal to improve flood predictions and warnings. Storm surge and coastal flooding killed 52 people and destroyed 7,000 homes. The area received 20-25 inches of rain over 10 days, causing rivers to crest up to 24 feet above flood stage. The storm surge was measured as high as 13 feet. Additional widespread impacts on the region included livestock and pet evacuations, water pollution from farm animal waste management sites, and backwater flooding due to inadequate bridge design. CI-FLOW focuses on the Tar-Pamlico and Neuse river basins of coastal North Carolina, the areas hit hardest by the effects of the 1999 hurricanes.

Flooding from Hurricane Irene in August, 2011 sliced through Highway 12 on the Outer Banks of North Carolina. Photo by The Program for the Study of Developed Shorelines, http://psds.wcu.edu

Benefits of CI-FLOW

- Routine predictions of total water level and its individual components for the coastal plain
- Demonstrates the value of a linked framework to provide comprehensive water quantity information
- If implemented operationally, potential reduction in loss of life and property from weather and water hazards in the Carolinas and across our nation



Hurricane Floyd takes aim at the North Carolina coast in 1999.

CI-FLOW partners

NSSL, with support from the NOAA National Sea Grant collaborates with the unique interdisciplinary team including the North Carolina, South Carolina, and Texas Sea Grant Programs, University of Oklahoma, Renaissance Computing Institute (RENCI), University of North Carolina at Chapel Hill, Seahorse Coastal Consulting, NWS Forecast Offices in Raleigh, and Newport/Morehead City, NWS Southeast River Forecast Center, NOAA's Coastal Services Center, NOAA in the Carolinas, NOAA Southeast and Caribbean Regional Team (SECART), NOAA-Integrated Ocean Observing System, Department of Homeland Security Coastal Hazards Center of Excellence, Centers for Ocean Sciences Education Excellence South-East, Coast Survey Development Laboratory and NWS Office of Hydrologic Development.